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Biological Characteristics and Population Status of Steelhead (*Oncorhynchus mykiss*) in Southeast Alaska

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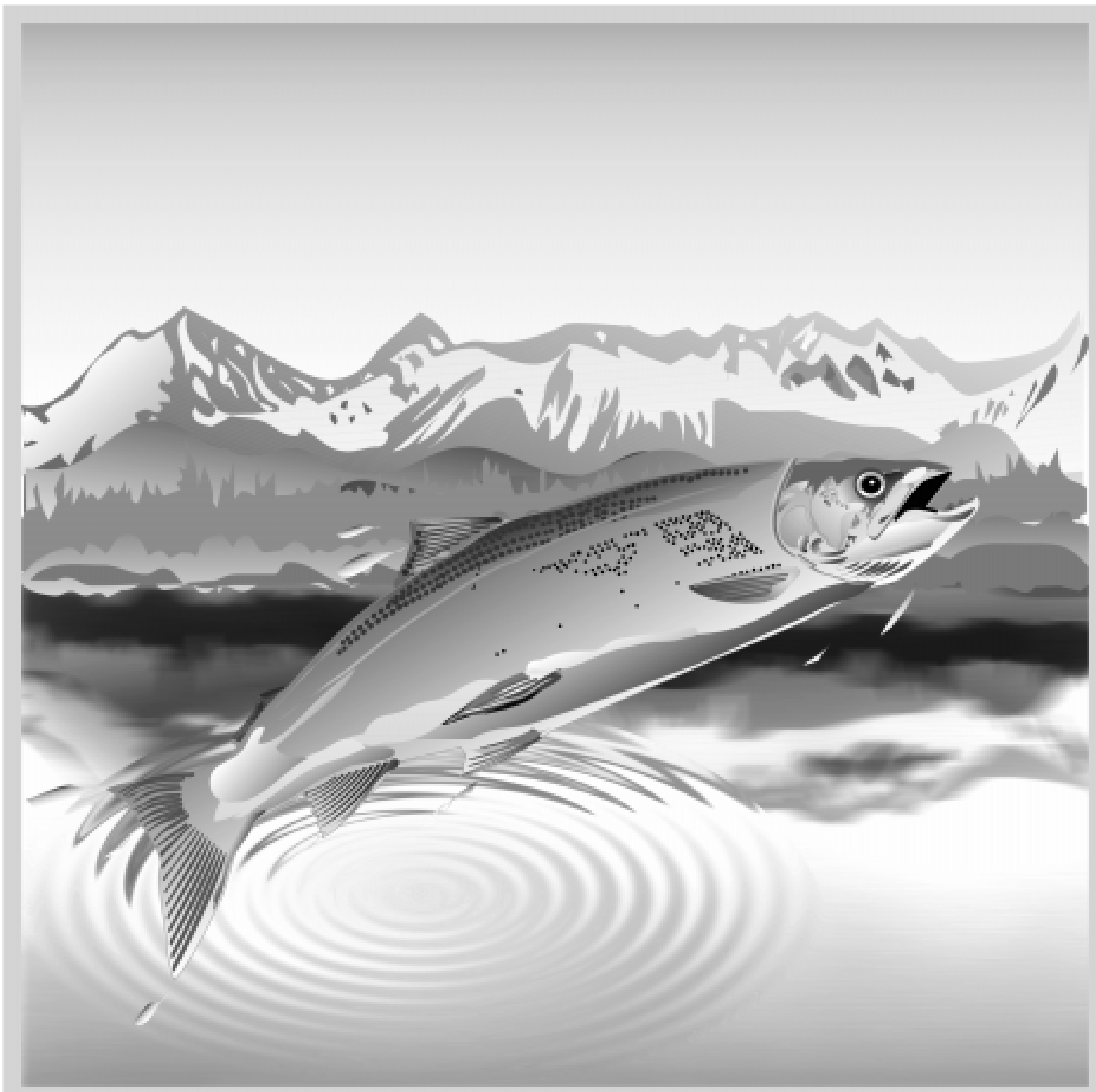

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Abstract

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We reviewed existing data to determine the range and distribution of steelhead (*Oncorhynchus mykiss*) in southeast Alaska, summarized biological characteristics, and determined population status of steelhead stocks. Unique or sensitive stocks that may require consideration in planning land management activities are identified within the data reviewed. Data sources were personal communications, reports, and unpublished data files of State and Federal agencies. Only eight winter-run stocks in southeast Alaska and two summer-run stocks in southwest Alaska had sufficient data to evaluate biological characteristics. Age structure, sex ratio, incidence and frequency of repeat spawning, and body length were similar among winter-run stocks, and consistent with coastwide trends of increasing freshwater age and body size of steelhead stocks in the northern portion of their range. Winter-run stocks appeared to have a greater proportion of repeat spawners (kelts) than summer-run stocks, and juvenile steelhead in the summer-run stocks generally spent 1 year less in both fresh water and the ocean. Assessment of escapement trends, run timing, and stock status is hindered by lack of adequate data both in number of stocks with sufficient data and the number of years of data available. Incomplete weir counts during immigration and emigration of adult fish and low sample sizes of escapement indices, both within and among years, decrease the reliability of estimates. Although stocks with sufficient data are not at risk, small run sizes that are typical of most steelhead stocks may be more susceptible to poor land management practices and overharvest than larger stocks.

Keywords: Steelhead, stock assessment, Alaska, management, biological review.

Contents

Introduction

Fisheries program managers of the USDA Forest Service identified the need to summarize biological characteristics and determine population status of anadromous salmonids in southeast Alaska because of declines in stocks of anadromous salmonids in California, Oregon, Idaho, and Washington (Nehlsen and others 1991). Their purpose was to identify unique or sensitive stocks that may require special consideration in planning land management activities on the Tongass National Forest. Reports by Halupka and others (1996a, 1996b, 1996c, 1996d, 1996e) summarize and review existing data with primary emphasis on escapement records of chinook (*Oncorhynchus tshawytcha* (Walbaum)), coho (*O. kitsutch* (Walbaum)), sockeye (*O. nerka* (Walbaum)), chum (*O. keta* (Walbaum)), and pink (*O. gorbuscha* (Walbaum)) salmon. Most data are from the Alaska Department of Fish and Game (ADFG), but records and interviews from various other State and Federal natural resource agencies are included.

Halupka and others (1996a) define salmon stocks according to Ricker (1972); that is, by the population of fish spawning in a particular tributary of a drainage during a specific season. They compile, summarize, and compare biological data on the intraspecific diversity of life history and demographic attributes among stocks, and evaluate population trends to identify unique characteristics and to determine the status of stocks. We present a similar evaluation of steelhead (*O. mykiss*) stocks in southeast and southwest Alaska. The objectives are to (1) determine the range and distribution of steelhead stocks in southeast Alaska; (2) characterize stocks according to age structure, sex ratio, incidence and frequency of multiple spawning, and body length, and compare these attributes among stocks; (3) determine timing of freshwater immigration and emigration of adult steelhead during spawning; (4) assess temporal population trends of specific stocks based on indices of escapement; and (5) identify factors that might place stocks at risk.

Steelhead Biology and General Life History

Steelhead are anadromous rainbow trout. In a thorough review of the literature, Burgner and others (1992) found no significant differences in genetic, morphological, and morphometric characteristics and concluded that the two differ only in their life history strategies. Thus, where the two forms are sympatric and not separated by barriers, each may produce progeny of the other life-history type. The native range of nonanadromous rainbow trout is more extensive than that of steelhead. Rainbow trout are found north from Rio del Presidio, Mexico, to the Kuskokwim River, Alaska, west across the Pacific Ocean to Asia, and south along the Kamchatka Peninsula, Siberian mainland, Commander Islands, and Greater Shantar Island (Behnke 1992, Burgner and others 1992, MacCrimmon 1971). Within this range, steelhead are found on the Kamchatka Peninsula, a few mainland streams in Asia, and perhaps the Commander Islands (Burgner and others 1992). In North America, the current southern limit of steelhead is Santa Monica Bay, California, and the northern limit is the Gulkana River and other tributaries of the Copper River, Alaska (Burger and others 1983; Williams 1972; Williams and Potterville 1983, 1984, 1985). Within Alaska, steelhead stocks are most abundant in the southeast portion of the State, but small numbers of stocks occur in Prince William Sound, Cook Inlet, Kodiak Archipelago, and Alaska Peninsula (Van Hulle 1985). Although river systems in these areas all drain into the Gulf of Alaska, a few small stocks occur in drainages on the northern side of the Alaska Peninsula (USDI Fish and Wildlife Service 1994).

Steelhead probably possess the greatest diversity of life-history characteristics of any Pacific Ocean salmonid (Behnke 1992, Burgner and others 1992). They typically are separated into two seasonal races, summer and winter, based on time of return to fresh water for spawning and degree of sexual maturity. Summer-run steelhead typically return to fresh water during May-October in sexually undeveloped condition, whereas, winter-run fish return in November-April with developed gonads (Smith 1969, Withler 1966). Although steelhead probably enter streams during all months of the year in North America (Withler 1966), precise timing is influenced by several environmental and regional factors such as water temperature and flow regime (Burgner and others 1992). Winter-run stocks are most abundant in southeast Alaska, but it is not uncommon for the same streams to contain a smaller summer-run (Didier and others 1991, Van Hulle 1985). Summer-run stocks are more abundant northwest of Yakutat.

Spawning occurs from late winter to early spring, in both summer- and winter-run steelhead; therefore, freshwater residency of summer-run steelhead is several months longer than that for winter-run steelhead. Even though spawning may take place at nearly the same time in streams with both runs, partial reproductive isolation may exist between runs (Leider and others 1984, Smith 1969). Summer-run fish may spawn in drainages farther from the ocean than those used by winter-run fish (Behnke 1992). Maximum spawning activity is thought to occur during late April to May for both runs in Alaska.

Steelhead fry emerge from redds 4 to 7 weeks after spawning, depending primarily on water temperature (Pauley and others 1986). They reside in streams for 1 to 5 years before migrating as smolts to the ocean (Burgner and others 1992). Because growth rates in streams depend on water temperatures, and size is the greatest determinant of age at which steelhead become smolts, there is a trend toward increasing age of smolts from south to north along the Pacific coast (Withler 1966). Throughout Alaska, most steelhead smolts migrate to the ocean after 3 or more years in fresh water (Van Hulle 1985). Coastwide timing of smolt emigration usually corresponds with high spring flows caused by melting snow during March-June. In 4 years of trapping at Petersburg Creek, Alaska, smolts began emigrating as early as late April and typically reached their maximum in the first week of June (Jones 1977b). Of all smolts sampled for age and length during this time ($n = 163$), 90 percent had spent three or four winters in the stream, and overall mean fork length was 176 mm (6.9 inches).

After 1 to 4 years of growth in salt water, steelhead return to their natal streams to spawn. An exception is a regional run of “half-pounders” occurring in northern California and southern Oregon that return to streams after only a few months at sea, but most are sexually undeveloped and do not spawn (Burgner and others 1992). Most steelhead returning to Alaska streams have spent 2 or more years at sea (Van Hulle 1985). In contrast to Pacific salmon that usually die soon after spawning, steelhead may survive their initial spawning run and return to spawn several times. Most repeat spawners (kelts) are females. Although Withler (1966) noted that the incidence of repeat spawning tended to decline in the northern portions of steelhead range in North America, spawning runs into Alaska streams may consist of 25 to 33 percent of repeat spawners (Didier and others 1991, Van Hulle 1985).

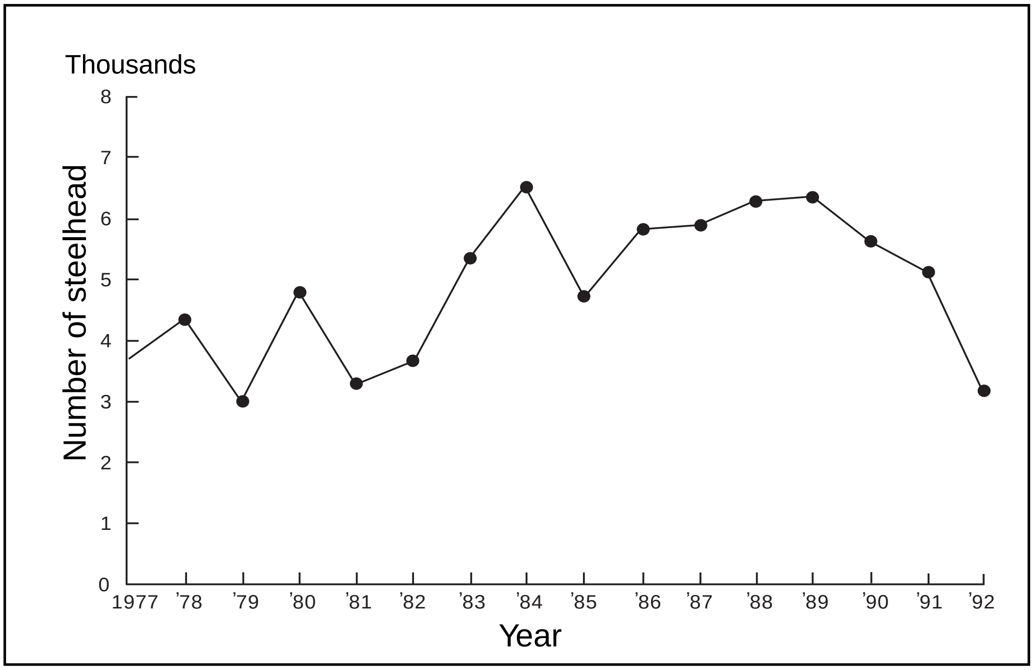

Figure 1—Annual sport harvest of steelhead in Alaska 1977-92 (after Didier and others 1991, Mills 1993).

Steelhead Management in Alaska

Steelhead are managed as a sport fish in Alaska. From 1977 to 1992, estimated annual harvest ranged from 2,978 fish in 1979 to 6,539 in 1984 (fig. 1; Didier and others 1991, Mills 1993), with over half of the fish harvested in the southeast region for 13 of the 16 years of record. Because of apparent declines in stocks throughout the State, more restrictive angling regulations have been implemented in recent years. For example, Jones (1994) reports that the Situk River was the only drainage in southeast Alaska with catch-and-release regulations in 1991. In 1992, 24 streams were restricted to catch-and-release angling and 48 in 1993. The 1994 sport fish regulations for southeast Alaska permitted a season harvest of two steelhead with a 914-mm (36-inch) minimum size limit, which was estimated to protect 95 percent of the wild fish (Jones 1994).

Steelhead are taken as incidental harvest in the commercial salmon fisheries and are part of subsistence fisheries throughout Alaska. Since 1969, the harvest of steelhead in the Alaska commercial fishery has ranged from 849 to 11,540 fish (fig. 2).[1] These values are conservative because they were reported by fish buyers, and do not include steelhead that were caught but not sold. Moreover, the proportion of steelhead in the commercial catch that originated from Alaska streams is not known. Jones (1994) found steelhead marked with coded wire tags from California, Oregon, Washington, Idaho, and British Columbia in the Alaska commercial harvest.

[1] C. Smith. Unpublished data. On file with: Alaska Department of Fish and Game, Division of Commercial Fishery Management and Development, 1255 W. 8th Street, Juneau, AK 99801.

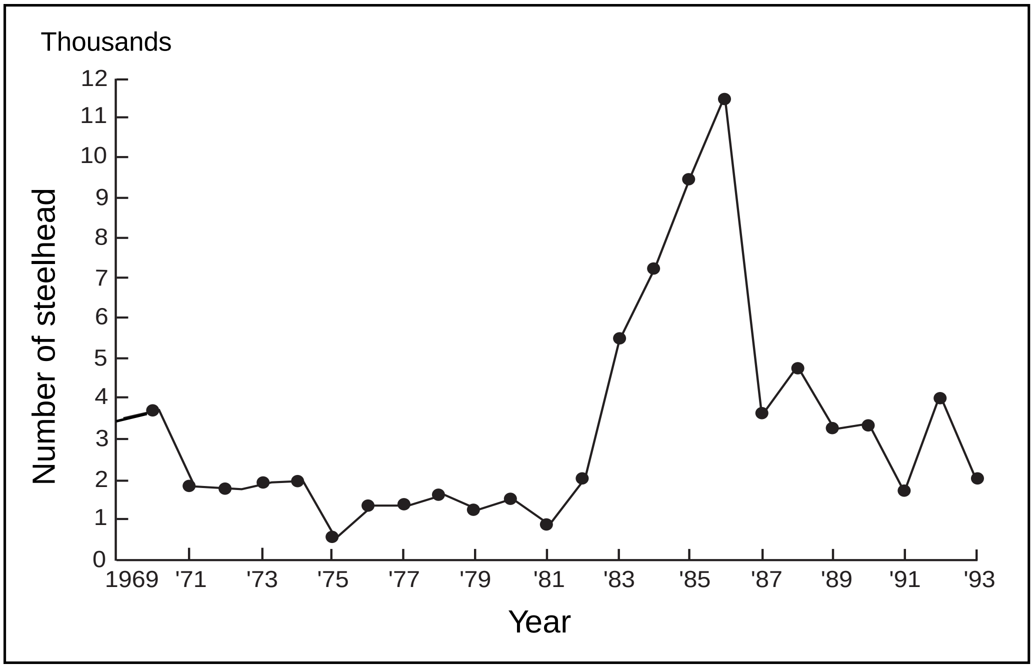

Figure 2—Annual commercial harvest of steelhead in Alaska 1969-93 (C. Smith, ADFG, Division of Commercial Fish, Juneau). Unpublished data. On file with: Alaska Department of Fish and Game, Commercial Fish Division, Juneau, AK.

Propagation and stocking of steelhead has been conducted in south-central and southwest Alaska since the early 1950s, and in southeast Alaska since the 1930s (Didier and others 1991). Technical limitations of rearing facilities (Schwan 1989) and controversies about the need to supplement wild stocks (Didier and others 1991) have limited recent stocking activities. Small steelhead stocks are currently maintained by private hatcheries for smolt releases primarily in the Klawock and Ketchikan areas in southeast Alaska.

Methods

Although most of our data are from steelhead stocks in southeast Alaska, their geographic area extends from the international boundary with Canada at Dixon Entrance north to the Yakutat area of Alaska; however, we include the remaining portions of steelhead range and use biological data from stocks in the Anchor River (Kodiak) and the Karluk River (Kenai Peninsula) (fig. 3). Within southeast Alaska, only eight streams had specific studies on steelhead: the Karta, Klawock, Situk, and Thorne Rivers and Petersburg, Peterson, Ward, and Sitkoh Creeks (Freeman and Hoffman 1989, 1990, 1991; Harding and Jones 1990, 1991, 1992, 1993, 1994). Most data from Ward Creek and the Klawock and Thorne Rivers consisted only of angler surveys, so data pertinent to biological characteristics of steelhead stocks were derived from limited samples of harvested steelhead (Hubartt 1989, 1990). Steelhead in the remaining five streams had been studied intensively for only 3 to 5 years.

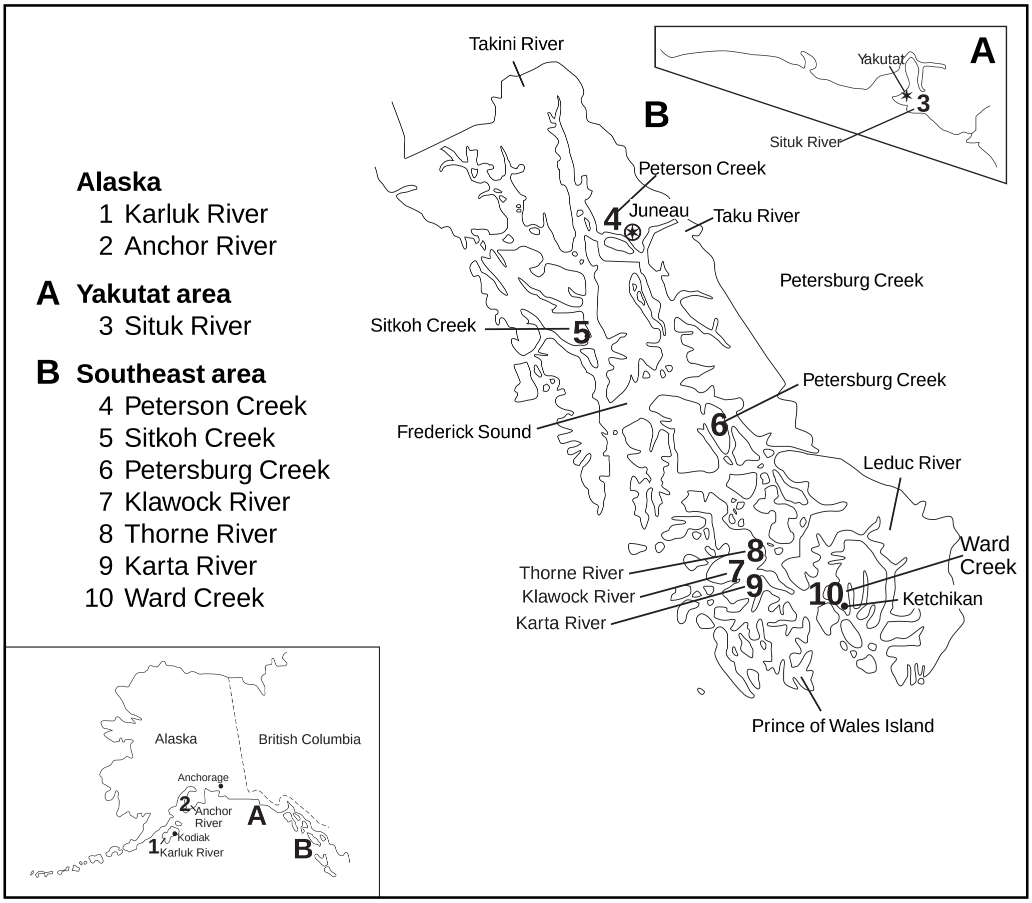

Figure 3—Locations of 10 steelhead stocks with sufficient data for analysis. Two summer-run steelhead stocks are located on Kodiak Island and the Kenai Peninsula; eight winter-run stocks are located from the Yakutat area, Situk River to Prince of Wales Island. The Takini, Taku Stikine, and Leduc Rivers have stocks that enter British Columbia.

Range and distribution of steelhead stocks in Alaska were determined from Van Hulle (1985) and data compiled by ADFG in 1988.[2] Steelhead occurrences recorded in the "Atlas of Waters Important for Spawning, Rearing, and Migration of Anadromous Fishes" —updated October 1994— (Alaska Department of Fish and Game 1993) were also included. The catalog number for each stream found in the 1993 catalog accompanying the Atlas also was included.

We used information from reports, data files, and personal communication with ADFG personnel. Reports by the ADFG, Division of Sport Fish, contain a variety of information concerning steelhead escapement, run timing, adult age, sex, and body size. Data are from fish collected at weirs specifically for steelhead or from fish sampled during creel

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[2] Harding, R. 1988. Unpublished data. On file with: Alaska Department of Fish and Game, Sport Fish Division, P.O. Box 240020, Douglas, AK 99824.

surveys. Steelhead are not fished as a commercial species and are not reported with the commercially important salmon species. Steelhead captured at weirs to enumerate commercial salmon escapement are recorded only as comments and are not reported in the computerized ADFG escapement database for commercial salmonids. These data were used only when they were included in reports by the ADFG. Additional data were gathered from published articles, symposia, and various reports, and from personal communications with the USDA Forest Service (FS), USDI Fish and Wildlife (FWS), and National Marine Fisheries Service (NMFS).

Not all sources were used to summarize biological characteristics to compare among stocks. Different or multiple sampling methods limit comparisons: data collected from fish during only a restricted period of a spawning run, operation of weirs during only a portion of a run, different length measures reported (that is, mid-eye-to-fork vs. fork length), and uncertainty in the method of aging or reporting freshwater and saltwater ages may introduce an unknown bias to the data. The biological data (for example, age classes, body length) were summarized within years for a given stream and presented as annual means, weighted by the number of fish in each age class. Grand means, calculated as the average of the annual means across years at a given stream, were used to summarize biological attributes and to make comparisons of age structure, sex ratio, and body length among stocks. Age distribution within a stock was derived from freshwater and saltwater ages estimated from scales; sex ratio and incidence and frequency of spawning were determined from all fish sampled, including those with scales regenerated before entering salt water. All body length measurements are fork length. Other measures such as mid-eye-to-fork were converted to fork length by using equations for ocean-caught coho salmon (Pahlke 1989).[3]

Ages are reported by using the European system (Narver 1969), whereby the number of winters spent in fresh water is followed by a period and then by the number of winters spent in salt water before the initial spawning run. Departures from this system and uncertainty in the aging methods used occurred in some studies of summer steelhead runs and are noted in the text. The ages presented in the original literature are reported. The most recent spawning check was omitted for age data in which only kelts were sampled after spawning. This allowed direct comparisons of spawning frequency and the incidence of repeat spawners among stocks. In some data sources, samples were reported separately by collection method and survey for a particular stream. Though these different methods are noted in the tables, no attempt was made to combine multiple data sets from a single source (report). Comparisons among streams were made from samples collected during the same season.

Mean dates of spawner immigration and emigration were calculated by using methods described by Mundy (1984) for 1 to 5 years that weirs were operated in four streams. Weirs often were hampered by high water and probably did not encompass the entire spawning run; therefore, only steelhead counts that showed an increase, peak, and decline throughout the run were used to determine trends in escapement and stock

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[3] Personal communication. 1995. Roger Harding, Alaska Department of Fish and Game, Sport Fish Division, P.O. Box 240020, Douglas, AK 99824.

status.[4,5] Escapement trends during a period of several years were used to determine stock status. Stock status was determined by using methods of Konkel and McIntyre (1987), and assigned to one of four classes: increasing, decreasing, not significant, or unknown (<7 years of counts).

Results

Distribution and Relative Stock Size

The greatest abundance of steelhead stocks occurs in the southeast region of Alaska (fig. 3, inset B). Steelhead were found in 581 streams within this region. Of these, 345 flowed directly into salt water. Eighty-seven of the 345 systems contained lakes from which steelhead were reported. Most systems were relatively small, but steelhead occurred in four large rivers, the Leduc (tributary of the Chickamin River), Stikine, Taku, and Takini (tributary of the Chilkat River) that extended into British Columbia (fig. 3). More than 80 percent of all identified streams (482) with steelhead were adjacent to or south of Frederick Sound. Moreover, within the southern portion of southeast Alaska, steelhead are known from 87 streams located on Prince of Wales Island alone (Harding and Jones 1993).

Steelhead escapement studies have been conducted on few streams in Alaska, and most occur in southeast Alaska. Tentative estimates of escapements, primarily based on professional judgment, were made for 331 streams. In less than 200 streams, escapements were thought to be under 100 fish (Jones 1994). Fifty-six streams were estimated to have runs over 500 fish, and 12 streams were thought to have runs over 1,000 fish. The Situk River in the northern portion of southeast Alaska near Yakutat has the largest steelhead run, with escapement estimates over 5,000 (Jones 1994). Escapement estimates of the summer-run stocks in the Karluk and Anchor rivers, near the northern limit of steelhead range, were generally over 1,000 fish.[6]

Age Structure

The most abundant age classes were typically 3.2, 3.3, 4.2, and 4.3 (table 1). Residence in fresh water ranged from 1 to 5 years and residence in salt water 1 to 6 years before the initial spawning run in the 10 steelhead stocks assessed. Most fish spent 3 to 4 years in fresh water and 2 to 3 years in salt water. Excluding stocks with hatchery fish and those with a small sample size such as the Thorne and Klawock Rivers and Ward Creek, the mean percentage of both female and male fish for the 5 remaining winter-run stocks ranged from 53 to 68 percent for the age classes 3.2 and 3.3, and from 12 to 38 percent for the age classes 4.2 and 4.3. The mean percentages of fish that spent either 3 or 4 years in fresh water generally were similar for both sexes. Fish that had migrated as smolts at 2 years were 11 to 15 percent of all fish in three of the five streams, whereas <4 percent spent 2 years in fresh water at Peterson and Sitkoh Creeks. Wild fish that spent 1 year in fresh water were observed only in the Situk River during 1970 (McHugh and others 1971, 1972), but these data were not included in table 1 because sexes were combined.

[4] Personal communication. 1995. T. Baker, Alaska Department of Fish and Game, Division of Commercial Fishery Management and Development, 333 Raspberry Road, Anchorage, AK 99515.

[5] Personal communication. 1995. B. Johnson, Alaska Department of Fish and Game, Division of Sport Fish, Yakutat, AK 99689.

[6] T. Baker. Unpublished data. On file with: Alaska Department of Fish and Game, Division of Commercial Fishery Management and Development, 333 Raspberry Road, Anchorage, AK 99515.

Table 1—Percentage of each age class (age class <1 included fish that spent 1 year in fresh water) of all adult steelhead during the initial spawning run from streams in Alaska[a]

Stream	Catalog number	Years	Sex	Age class <1	2.1	2.2	2.3	2.4	2.5	2.6	3.1	3.2	3.3	3.4	3.5	3.6	4.1	4.2	4.3	5.1	5.2	5.3	n
				Years																			
Winter-run stocks:																							
Karta River	102-60-10870	3	Female			6	5					40	25					16	7		1		1,129
			Male			10	2				1	48	13				1	16	8		1		620
Thorne River	102-70-10580	2	Both		3	8	11				5	35	30				3	5					37
Klawock River[b]	103-60-10470	1	Both			4	8				4	26	32				2	15	8				33
Petersburg Creek	106-44-10600	5	Female			4	8				4	26	32				2	15	8				810
			Male		1	8	6				6	37	18				2	17	4	1	1		598
Peterson Creek	111-50-10100	3	Female				1				1	30	23				2	25	13		3		210
			Male			3	1				1	45	9				2	34	4		3		188
Ward Creek[b]	112-47-10150	3	Both	15		8	6			1		34	20					6	9				144
Sitkoh Creek	113-59-10040	3	Female				1					25	34					20	16		2	1	663
			Male			2	1					43	15					29	6		3		543
Situk River	182-70-10100	3	Female			3	9	1	2			26	42	1	2	<1		9	3		1		269
			Male			6	5	1				44	22				1	13	5	1	2	1	189
Summer-run stocks:																							
Anchor River	244-10-10010	8	Female		1	15					7	72					2	3					424
			Male		4	9					44	35	1				2	4					315
Karluk River[c]	255-10-10010	2	Female			9	62					7	20					1	1				561
			Male		1	54	20			1		16	7										500

[a] Years are the number of years of data included.

[b] Includes some hatchery fish.

[c] Winter spent in fresh water during initial spawning run was reported as if in salt water.

Summer-run stocks spent less time in fresh water than did winter-run stocks (table 1). Both summer-run stocks had substantially fewer fish that spent 4 years in fresh water than did winter-run stocks. In the Anchor River, over 70 percent of both sexes spent 3 years in fresh water, and similar percentages of both sexes spent 2 years in fresh water in the Karluk River. In both rivers, most fish spent at least 2 years in salt water before their initial spawning run, except for males at the Anchor River. Of these, half had spent only 1 year in salt water.

Differences in mean freshwater and saltwater age corresponded with differences in age structure between the two life-history types. The mean freshwater ages of summer-run fish from the Karluk and Anchor Rivers were $\leq$3 years for both males and females, whereas all winter-run fish, except those in Thorne River which had a sample size of 37 fish during a 2-year period, were $\geq$3 years (table 2). Anchor River fish spent less than 2 years in salt water. Mean saltwater age was $\geq$2 years in the remaining stocks except for male repeat spawners in Peterson Creek (table 2). No consistent differences in mean age were apparent among winter-run stocks. Male steelhead, however, had consistently lower mean saltwater ages than female fish in all stocks for which sex was determined.

Sex Ratio

The mean percentage of males spawning for the first time (that is, initial spawners) was between 40 and 51 percent for both winter- and summer-run fish (table 3), but high variability among years was observed in some streams (for example, Peterson Creek). A lower percentage of males was observed among repeat spawners in the winter-run stocks (25 to 35 percent) compared to summer-run stocks (43 and 50 percent).

Repeat Spawning

The number of spawning runs made by kelts, based on scale analysis, ranged from one to four in the winter-run stocks and from one to two in the summer-run stocks (table 3). The number of fish decreased in each successive run (table 4). On average, kelts made up 21 to 51 percent of all fish in both summer- and winter-run stocks. The highest mean (51 percent) was from Peterson Creek because 70 percent of the 1989 sample was composed of repeat spawners.

Table 2—Mean freshwater and saltwater age (SD) of steelhead during their initial spawning run for years in which similar data were collected in Alaska streams (M = male, F = female, B = both male and female)

			Initial spawners						Repeat spawners						All fish					
			Freshwater age			Saltwater age			Freshwater age			Saltwater age			Freshwater age			Saltwater age		
Stream	Catalog number	Years	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B	M	F	B
Winter-run stocks:																				
Karta River	102-60-10870	3	3.4 (0.4)	3.3 (0.4)	3.4 (0.5)	2.4 (0.1)	2.5 (0.1)	2.4 (0.1)	3.3 (0.3)	3.3 (0.3)	3.3 (0.3)	2.1 (0.1)	2.2 (0.1)	2.2 (0.1)	3.4 (0.4)	3.3 (0.3)	3.3 (0.3)	2.3 (0.1)	2.4 (0.1)	2.4 (0.1)
Thorne River	102-70-10580	2			2.9 (0.1)			2.5 (0.2)			2.9 (0.1)			1.6 (0.3)			2.9 (0.1)			2.3 (0.2)
Klawock River[a]	103-60-10470	1															3.4 (—)			2.7 (—)
Petersburg Creek	106-44-10600	5	3.2 (0.2)	3.1 (0.1)	3.1 (0.1)	2.4 (0.1)	2.7 (0.1)	2.5 (0.1)	3.1 (0.2)	3.2 (0.2)	3.1 (0.2)	1.7 (0.4)	2.0 (0.4)	1.9 (0.4)	3.1 (0.2)	3.1 (0.2)	3.2 (0.2)	2.2 (0.1)	2.4 (0.1)	2.3 (0.1)
Peterson Creek	111-50-10100	3	3.4 (0.1)	3.4 (0.1)	3.4 (0.1)	2.3 (0.2)	2.6 (0.1)	2.4 (0.2)	3.4 (0.1)	3.5 (0.1)	3.4 (0.1)	2.0 (0.1)	2.1 (0.1)	2.1 (0.1)	3.4 (0.1)	3.5 (0.1)	3.4 (0.1)	2.0 (0.1)	2.3 (0.1)	2.2 (0.1)
Ward Creek[a]	112-47-10150	3															2.9 (0.3)			2.4 (<0.1)
Sitkoh Creek	113-59-10040	3	3.4 (0.1)	3.4 (0.1)	3.4 (0.1)	2.2 (<0.1)	2.6 (<0.1)	2.4 (0.1)	3.4 (<0.1)	3.4 (0.1)	3.4 (0.1)	2.2 (0.1)	2.5 (0.1)	2.4 (0.1)	3.4 (0.1)	3.4 (0.1)	3.4 (0.1)	2.2 (<0.1)	2.5 (0.1)	2.4 (0.1)
Situk River	182-70-10100	3	3.1 (0.3)	3.1 (0.3)	3.1 (0.3)	2.4 (<0.1)	2.6 (0.1)	2.5 (0.2)	3.0 (0.2)	3.1 (0.5)	3.1 (0.4)	2.2 (0.2)	2.9 (0.8)	2.7 (0.7)	3.1 (0.3)	3.1 (0.3)	3.1 (0.3)	2.4 (0.2)	2.7 (0.5)	2.6 (0.4)
Summer-run stocks:																				
Anchor River	244-10-10010	8	3.0 (0.1)	3.0 (0.1)	2.9 (0.1)	1.5 (0.2)	1.9 (0.1)	1.8 (0.1)	2.9 (0.1)	2.8 (0.2)	2.9 (0.1)	1.5 (0.6)	1.8 (0.2)	1.7 (0.3)	3.0 (0.1)	2.9 (0.1)	2.9 (0.1)	1.5 (0.2)	1.9 (0.1)	1.7 (0.1)
Karluk River	255-10-10010	2	2.3 (<0.1)	2.4 (0.1)	2.3 (0.1)	2.4 (0.2)	2.9 (0.1)	2.6 (0.2)	2.2 (0.2)	2.5 (0.2)	2.4 (0.1)	2.1 (<0.1)	2.5 (0.4)	2.4 (0.3) (0.1)	2.2 (0.2)	2.4 (0.1)	2.3 (0.1)	2.4 (0.1)	2.8 (0.3)	2.6

[a] Includes hatchery fish.

Table 3—Total number of male and female steelhead and mean percentage of males for initial spawners, repeat spawners, and all fish for all years in which similar data were collected. The mean percentage of repeat spawners of all fish and range in the number of previous spawning runs also are given. Ranges are in parentheses (M = male, F = female)

		Initial spawners			Repeat spawners			Repeat spawners				
Stream	Years	M	F	M (%)	M	F	M (%)	M	F	M	Repeat spawners (%)	Previous spawnings (range)
Winter-run stocks:												
Karta River	3	443	653	40 (39-42)	183	498	25 (20-28)	626	1,151	35 (33-44)	38 (33-44)	1-4
Petersburg Creek	5	406	451	48 (46-50)	192	359	35 (25-45)	598	810	43 (36-48)	38 (30-43)	1-4
Peterson Creek	3	141	105	49 (22-66)	67	142	32 (26-36)	208	247	43 (31-51)	51 (34-70)	1-2
Sitkoh Creek	3	444	382	51 (40-57)	115	317	28 (20-32)	559	702	42 (36-49)	38 (24-46)	1-4
Situk River	3	161	173	50 (34-65)	37	100	30 (20-45)	198	273	44 (31-57)	33 (25-41)	1-4
Summer-run stocks:												
Anchor River	8	284	357	45 (30-50)	69	104	43 (33-60)	353	461	43 (33-48)	21 (11-33)	1-2
Karluk River	10	952	1,169	41 (29-67)	210	208	50 (33-100)	1,130	1,376	44 (28-65)	21 (13-38)	1-2

The frequency of repeat spawning was higher for females than for males in both winter and summer-run stocks (table 4). In winter-run stocks, a mean of 77-89 percent of males had spawned one time previously, 10 to 16 percent two times, and ≤4 percent for three times. Males with four spawning checks were present in only two systems, the Karta (<1 percent) and Situk (4 percent) Rivers. In the winter-run stocks, 60 to 70 percent of the females had one spawning check, 18 to 28 percent had two, and 6 to 12 percent had three or more checks. Females with four spawning checks were present in all winter-run stocks except the Situk River.

Table 4—Number of previous spawning runs made by female and male steelhead repeat spawners in Alaska streams[a]

			Number of spawning runs									
Stream catalog			Female					Male				
number	Source	Year	n	1	2	3	4	n	1	2	3	4
Winter-run stocks:												
Karta River	Jones 1984	1983	193	56	29	12	4	76	72	20	7	1
102-60-10870	Hoffman and others 1990	1990	1,989	257	75	21	4	<1	95	90	9	1
	Harding and Jones 1993	1993	1,992	48	79	19	2		12	92	8	
Mean				70	23	6	2		86	12	3	>1
Petersburg Creek	Jones 1972	1971	39	51	33	13	3	44	77	21	2	
106-44-10600	Jones 1973	1972	117	65	25	9	2	60	83	15	2	
	Jones 1974	1973	84	62	26	11	1	29	76	17	7	
	Jones 1975	1974	66	49	39	8	5	24	83	13	4	
	Jones 1976	1975	34	74	18	3	6	25	84	12	4	
Mean				60	28	9	3		81	16	4	
Peterson Creek	Harding and Jones 1991	1989	40	60	30	10		22	77	18	5	
111-50-10100	Harding and Jones 1991	1990	56	59	34	5	2	20	95	5		
	Harding and Jones 1992	1991	44	75	15	18	7	24	83	17		
Mean				65	27	7	1		85	13	2	
Sitkoh Creek	Jones 1983a	1982	111	66	25	8	1	52	94	6		
113-59-10040	Jones and others 1991	1990	149	62	28	9	1	37	89	11		
	Harding and Jones 1994	1993	56	82	18			26	85	15		
Mean				70	24	6	1		89	10		
Situk River	Jones 1983b	1982	57	67	21			14	86	14		
108-70-10100	Glynn and Elliott 1993	1992	18	67	33				12	67	17	8
Mean				67	27	6				77	16	4
Summer-run stocks:												
Anchor River	Wallis and Hammarstrom 1979	1978	9	78	22				8	88	13	
244-10-10100	Wallis and Hammarstrom 1980	1979	71	71	29				3	100		
	Wallis and Balland 1981	1980	21	10					12	92	8	
	Wallis and Balland 1982	1981	6	83	17				4	75	25	
	Wallis and Balland 1983	1982	21	81	19				17	100		
	Wallis and Balland 1984	1983	18	83	17				10	100		
	Balland 1985	1984	16	81	19				12	83	17	
	Balland 1986	1985	6	83	17				3	100	17	
Mean				83	18					92	9	
Karluk River	Van Hulle 1972	1971	15	93	7				9	89	11	
255-10-10100	Van Hulle and Murray 1973	1972	11	82	18				27	74	26	
	Van Hulle and Murray 1975	1974	4		100				4	100		
	Van Hulle and Murray 1977	1976	2	10					12	83	17	
	Van Hulle and Murray 1978	1977	40	63	38				24	88	13	
	Murray and Van Hulle 1979	1978	10	100					10	100		
	Murray and Van Hulle 1980	1979	25	96	4				13	100		
	Van Hulle and Murray 1981	1980							5	80	20	
	Murray 1983	1982	5	10					8	100		
	Begich 1992	1992	46	80	20				45	93	7	
	Begich 1993	1993	49	92	8				49	100		
Mean				81	19					92	9	

[a] Values are percentages of the total for each year.

Table 5—Mean fork length of female and male steelhead collected in Alaska streams

Stream	Catalog number	Years	Length of female n	Length of female (mm)	Length of female SD	Length of male n	Length of male (mm)	Length of male SD
Winter-run stocks:								
Karta River	102-60-10870	3	1,134	745	2	623	737	19
Peterson Creek	111-50-10100	3	210	766	11	182	717	20
Sitkoh Creek	113-59-10040	3	663	777	9	559	736	9
Situk River	182-70-10100	3	266	741	18	171	727	15
Summer-run stocks:								
Anchor River	244-10-10100	8	436	704	9	315	675	27
Karluk River [a]	255-10-10100	4	733	637	11	632	636	60

[a] Data are from kelts only, collected in 1976.

Body Length

Female steelhead were consistently larger than male fish in both winter- and summer-run stocks for means of all age groups and stocks (table 5). Within all stocks of winter-run fish, mean body length of females was 8 to 49 mm (0.3 to 1.9 inches) greater than that of males, whereas differences between sexes were less in the two summer-run stocks, 29 mm (1.1 inches) for the Anchor River and 1 mm (0.04 inch) for the Karluk River. Mean length was similar within sexes among winter stocks with a range of 36 mm (1.4 inches) for females and 20 mm (0.8 inch) for males. Fish from the summer-run stock in the Anchor River were substantially larger than those from the Karluk River (69 mm [2.7 inches] for females, 39 mm [1.5 inches] for males).

Run Timing

Few streams had weirs to enumerate steelhead immigration and emigration, and those that did suffered from failures because of high flows. Many were not operated during the entire run cycle. Information on run timing in the data sources typically approximated the period of maximum escapement, but many represented incomplete counts because of weir failure. Because of these limitations and because early and late segments of the runs were probably missed in virtually all sources, the estimates of run timing reported here are not exact.

Only four streams had operational weirs that could be used to estimate mean date of immigration, the Karta River and Peterson and Sitkoh Creeks for 3 years each, and 1 year for the Situk River (table 6). Of these four stocks, Karta River steelhead entered fresh water to spawn earlier (the third and last weeks of April) than the other

Table 6—Mean date of immigration and emigration (month and day) and total number of spawning steelhead for streams with weirs in southeast Alaska (methods after Mundy 1984) [a]

		Sample			Immigration			Emigration		
Stream	Catalog number	Year	Start	End	Mean Date	SD (d)	n	Mean Date	SD (d)	n
Karta River	102-60-10870	1983[b]	4/07	6/05	4/18	10.2	375	5/16	4.8	479
		1989	3/24	6/09	4/25	11.4	1,118			
		1992	4/07	6/01	4/26	10.0	185	5/18	9.0	347
Peterson Creek	111-50-10100	1989	5/02	6/04	5/16	5.8	222			165
		1990	4/13	6/04	5/16	8.0	179			114
		1991	4/21	6/05	5/16	8.3	218	6/04	5.1	91
Sitkoh Creek	113-59-10040	1982	4/15	5/31	5/11	8.3	690			
		1990	4/05	6/01	5/03	10.9	661			
		1993	4/10	6/01	5/05	22.1	520	5/22	38.5	332
Situk River	182-70-10100	1988	6/07	8/08			60	6/20	10.5	1,211
		1989	5/26	8/16			128	6/14	19.6	5,867
		1990	5/07	7/27			741	5/30	8.8	3,639
		1991[c]	5/09	7/27			394	6/23	6.4	2,490
		1992[d]	4/18	7/17	5/01	9.8	1,079	6/04	11.2	2,976

[a] Missing values are for years in which data were not available or timing of weir operation was thought to have missed a substantial portion of the run.
[b] Biweekly counts reported. Dates based on midpoint of mean periods.
[c] Weir not operated May 28 -June 9.
[d] Weir not operated May 4 -15.

three stocks. Fish in Peterson Creek were the latest (third week of May), whereas the steelhead run in Sitkoh Creek was intermediate (first or second week of May). The mean date of immigration based on 1 year of data at the Situk River was closer to that of Sitkoh Creek than the other two streams. The mean date of emigration ranged from the third week of May for the Karta River, the fourth week of May for Sitkoh Creek, and the first week of June for Peterson Creek. For 5 years of data from the Situk River, mean date of emigration ranged from the last week of May to the fourth week of June. Relative to the number of days that weirs were operated in all four streams, standard deviations for mean dates of immigration and emigration suggest that steelhead movement is sporadic.

Stock Status

Adult counts or other indices of escapement for 3 or more years existed for 11 stocks of steelhead, including the Anchor and Karluk River stocks (table 7). Seven or more years of information was available for five stocks, which was the criterion used by Konkel and McIntyre (1987) to evaluate trends in spawning populations of anadromous salmonids throughout the Pacific coast. Regression analysis of maximum annual escapement index on year indicated no significant trend in four of these streams, but the Situk River showed a significant increase in index values through time (table 7). The index values were extremely variable, and the coefficients of variation ranged from 17 percent to over 100 percent. For example, year explained only 42 percent of the variance in temporal changes in index values at the Situk River.

Table 7—Trends in maximum escapement indices of adult steelhead for streams with 3 or more years of data in Alaska streams based on linear regression (methods after Konkel and McIntyre 1987)[a]

Stream		Sample		Escapement			Slope		Change				
Name	Catalog number	n	type	Mean	SD	CV	b	SE(b)	Percent	r^2	t	P	Status
Winter-run stocks:													
Pleasant Creek	111-12-10050	3	F	28.7	13.2	46	-1.31	.59	-4.6	0.83	-2.21	0.27	U
Admiralty Creek	111-41-10050	6	F	14.2	11.7	82	-2.71	1.18	-19.8	.57	-2.29	.08	U
Windfall Lake Creek	111-50-10060	6	F	2.2	1.9	86	.89	.32	40.5	.66	2.78	.05	U
Peterson Creek	111-50-10100	9	F	13.0	12.3	94	-2.10	1.61	-16.2	.20	-1.30	.23	S
Bear Creek	111-50-10800	4	F	4.5	4.7	105	1.70	1.73	37.8	.32	.98	.43	U
Kadashan River	112-42-10250	3	F	37.3	36.0	96	-6.58	7.69	-17.6	.42	-.86	.55	U
Sitkoh Creek	113-59-10040	16	F	55.8	38.0	68	.71	1.75	1.3	.01	.41	.69	S
Sandy Bay	113-21-10020	3	F	24.7	4.1	17	-1.32	.84	-5.3	.71	-1.58	.36	U
Situk River[b]	182-70-10100	20	FL	1,115.7	1,114.7	100	124.74	34.81	11.2	.42	3.58	<.01	I
Winter-run stocks:													
Anchor River	244-10-10100	9	E,W	1,628.2	1,097.8	67	25.50	28.72	1.7	.10	.89	.40	S
Karluk River	255-10-10100	17	W	1,671.0	1,215.8	73	-5.75	62.15	-.3	<.01	-.09	.93	S

[a] Sample types: FL = float count, F = foot count, E = estimated, W = weir. Status: I = increasing, D = decreasing (0.05), S = stable (P > 0.05), U = unknown (<7 years of data).

[b] Similar results were obtained from 17 years of steelhead counts at a weir. Personal communication. 1995. T. Baker, Alaska Department of Fish and Game, Division of Commercial Fishery Management and Development, 333 Rasberry Road, Anchorage, AK 99515.

Other Studies

The following studies are grouped into eight categories that include weir counts that are not compatible with those used in the escapement estimates, smolt counts, radiotelemetry studies, and various biological measurements. The data were not used because they were either inconsistent with other sources or were collected sporadically. In some cases, studies are in progress. The studies are listed by category but are not summarized.

1. Earlier weir counts of steelhead were conducted at Sitkoh Creek[7] in 1938, the Situk River (Knapp 1952), and the Anchor River (Allin 1954, 1958). Although escapement estimates derived from weir counts at the Anchor River were used in assessing stock status, the sources for the other streams were not used because data consisted of kelt counts at the Situk River, and weekly immigrant counts at Sitkoh

[7] Chipperfield, W.A. 1938. Unpublished report to the Forest Service on Dolly Varden research in Sitkoh Bay streams. On file with: A. Schmidt, Alaska Department of Fish and Game, 304 Lake Street, Sitka, Alaska 99835.

Creek. In both cases, a longer record of adult escapement was collected by using foot counts rather than weirs. References to steelhead encountered at weirs in streams on Kodiak Island other than the Karluk River can be found in Van Hulle and Murray (1981), Murray (1982, 1984, 1985, 1986), Sonnichsen (1990), and Schwarz (1994). Additional information on steelhead in the Anchor River and the surrounding area of the Kenai Peninsula are found in Larson and others (1988), Larson and Balland (1989), Larson (1990, 1993), and Redick (1968).

2. The distribution and biological characteristics of steelhead have been monitored at the limit of their range on the Alaska Peninsula to establish a baseline data set to determine the potential effects of climate change (Adams 1992, Irving 1991, USDI Fish and Wildlife Service 1994).

3. Radiotelemetry was used to determine distribution and spawning areas of steelhead in the Situk River (Johnson 1991), Karta River (Hoffman and others 1990), Karluk River (Chatto 1987), Anchor River (Wallis and Balland 1981, 1982), and the Copper River and its tributaries (Burger and others 1983; Williams and Potterville 1983, 1984).

4. Jones (1977a, 1977b) summarized the results of 4 years (1972-75) of smolt trapping in Petersburg Creek. Sex, age, and body length were recorded for 78 smolts emigrating from the Karta River (Harding and Jones 1993), and 80 smolts emigrating from Sitkoh Creek (Harding and Jones (1994). Harding and Jones (1992) investigated the contribution of juvenile rainbow trout from above a barrier to steelhead smolt production below the barrier in Peterson Creek. Freeman (1992) evaluated summer growth of hatchery-released smolts in the Ward Creek drainage system. Thedinga and others (1993, 1994) conducted extensive trapping of juvenile salmonids in the Situk River drainage to assess the projected effects of habitat alterations caused by flooding because of the formation of a glacial lake. A steelhead life-history study was conducted in the Anchor River based on limited results from smolt trapping (Balland 1985; Wallis and Balland 1981, 1982, 1983, 1984).

5. Fecundity was determined for samples of steelhead in Petersburg Creek (Jones 1974, 1975), and the Anchor River (Wallis and Balland 1983, 1984; Larson and Balland 1989).

6. Occurrence of steelhead in commercial harvests was recorded for the Situk River (Didier and Marshall 1991). Begich (1992, 1993) and Schwarz (1994) discussed steelhead harvested in commercial and subsistence fisheries in the Kodiak Island area.

7. Johnson (1990, 1991) tested techniques of using fish counters to enumerate steelhead immigrating into the Situk River.

8. Studies are currently underway to determine loci to differentiate among steelhead stocks [8] [9] and characterize spawning habitat in tributaries of the Copper River.[10] [11] The Forest Service also is monitoring escapement in several streams.[12] [13] [14] [15]

Discussion

Common trends were evident among Alaska winter-run steelhead stocks with respect to age structure, sex ratio, incidence and frequency of repeat spawning, and body length, although there was considerable variability. Most fish spent 3 or 4 years in fresh water before emigrating to sea as smolts, and adults made their initial spawning run after 2 or 3 years of residence in the ocean. Although the sex ratio of fish on their initial spawning run was close to 50 percent for each sex, females were usually more abundant among repeat spawners. This has been attributed to higher survival of females because they spawn at one location and leave the stream, whereas males tend to remain in fresh water longer and interact with other males during many spawning attempts (Shapovalov and Taft 1954, Withler 1966). For example, in two southeast Alaska streams, Petersburg Creek and the Karta River, freshwater residency of female winter-run steelhead (27.8 to 35.5 days mean range) was several days less than of males (32.8 to 45.5 days mean range) during the spawning run (Hoffman and others 1990, Jones 1974, 1975). About a third to one-half of the spawning runs consisted of repeat spawners. Most of these had spawned one or two times previously, but more females than males had spawned three or four times. Adult body length was similar between winter- and summer-run stocks, with females being slightly larger than males.

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[8] Personal communication. 1995. C. Seifeit, ADFG, Division of Sport Fish, P.O. Box 240020, Douglas, AK 99824.

[9] Personal communication. 1995. T. Gharret, School of Fisheries, University of Alaska, southeast, Juneau, AK 99801.

[10] Personal communication. 1995. S. Brink, School of Fisheries, University of Alaska, Fairbanks, AK 99709.

[11] Personal communication. 1995. D. Tol, USDI, Bureau of Land Management, 222 West 7th Ave. No. 3, Anchorage, AK 99513.

[12] Personal communication. 1995. D. Aho, USDA, Forest Service, Petersburg Ranger District, P.O. Box 309, Petersburg, AK 99833.

[13] Personal communication. 1995. J. Hannon, USDA Forest Service, Craig Ranger District, P.O. 500, Craig, AK 99921.

[14] Personal communication. 1995. M. Laker, USDA Forest Service, Admiralty Island National Monument, 8431 Old Dairy Rd., Juneau, AK 99801.

[15] Personal communication. 1995. C. Riley, USDA Forest Service, Hoonah Ranger District, P.O. Box 135, Hoonah, AK 99829.

Attributes observed for many of the Alaska stocks were similar to those observed for Keogh River steelhead on Vancouver Island, British Columbia (Ward and Slaney 1988), with the exception of incidence of repeat spawners and body length. Over the long-term study, repeat spawners averaged about 10 percent of the total spawning run in the Keogh River, but repeat spawners were proportionally more abundant in Alaska-winter-run stocks. Mean fork length for fish in the Keogh River (714 mm [28.1 inches] female, 731 mm [28.8 inches] male, all ages combined) tended to be less than that of females in Alaska (741 to 777 mm [29.2 to 30.5 inches]), but similar for males (717 to 737 mm [28.2 to 29.0 inches]). Males also were smaller than females in all Alaska stocks. Smaller body length of fish in the Keogh River compared to Alaska steelhead may be related to higher incidence of repeat spawners in Alaska (older fish) and possibly the influence of shorter marine residence of Canadian fish. During most years, fish immigrating into the Keogh River were sampled during February-May, whereas sampling of Alaska stocks usually did not begin until April.

Differences in attributes were observed between winter- and summer-run stocks of Alaska steelhead. Summer-run stocks tended to spend 1 year less in both fresh water and salt water before making their initial spawning run. About a fifth of the fish in the summer-run stocks were repeat spawners and had spawned one or two times previously. Summer-run fish entered fresh water to spawn several months before winter-run stocks, thereby resulting in a consistently lower body length of summer-run fish than was observed for winter-run fish (Ward and Slaney 1988, Withler 1966). For two summer-run stocks, body length of both females and males from the Karluk River was less than that of fish from the Anchor River. These differences may have been confounded by the sampling times and methods used at each river. All fish at the Anchor River were immigrants, and most scale samples were obtained from harvested fish, whereas at the Karluk River, all fish used in the data summaries were kelts and most were sampled at a weir. Samples from creel surveys tend to be biased because anglers tend to selectively keep larger females (Withler 1966).

Based on over a decade of trapping adults and smolts at a counting fence during 1975-86, Ward and Slaney (1988, 1989) and Ward and others (1989) concluded that adult run size and age structure varied directly with smolt abundance and body size, which influenced ocean survival. Furthermore, ocean survival of smolts that emigrated in 1982 was twice the long-term average, which was attributed to increased marine temperatures because of an El Niño event. They also documented an order-of-magnitude variation in the number of returning adults and, during a portion of the study, adult age structure differed biennially. The variability observed in this stock during the long-term study emphasizes the tentative nature of conclusions that can be made about Alaska steelhead stocks for which only limited data are available.

Withler (1966) compiled and summarized biological data from eight stocks of steelhead in southern British Columbia and compared these to similar data for other stocks in California, Oregon, and Washington. Although these data were obtained using various sampling methods, and both summer- and winter-run stocks were represented, coastwide trends in steelhead life-history characteristics were identified. From south to north, observations included increasing body length, the amount of time fish spent in fresh water and salt water, and decreasing incidence of repeat spawners; but sex ratio was similar coastwide (about 50 percent female and male). The primary environmental factor thought to influence these trends was mean monthly water temperature, which declined in the northern regions. Characteristics of Alaska steelhead correspond to these trends, except that repeat spawners in Alaska were proportionally more abundant than in many of the southern stocks. Postspawning mortality including fishing pressure is lower in southeast Alaska than in southern regions of the Pacific coast in North America.

No unique biological characteristics were identified from the limited data available for the two summer-run stocks in south-central and southwestern Alaska and eight winter-run stocks in southeast Alaska. Although winter-run steelhead are dominant in southeast Alaska, both summer- and winter-run stocks occur in large watersheds with sufficient winter habitat throughout the region.[16] Summer-run stocks in southeast Alaska have not been studied as intensively as the more abundant winter-run stocks. The summer-run stock in the Plotnikof River on southwest Baranof Island enters fresh water during an extended period with fish arriving as early as July, which differs from summer-run stocks on Vancouver Island, British Columbia that typically move into fresh water during September (Jones 1977a, Schmidt 1983, Van Hulle 1985). The Plotnikof River has a 5-m (16.25 foot) waterfall at the mouth of the river, and passage over the falls may be controlled by flow conditions. It also supports an early run of coho salmon, which may be unusual (Halupka and others 1996b). Similar characteristics may exist in other summer-run stocks in southeast Alaska,[17] but data are either lacking or unconfirmed.

Risk Factors

The small size of most steelhead stocks makes them susceptible to extinction through habitat degradation or overfishing. Small populations are at greater risk of extinction than large populations because of demographic, environmental, and genetic uncertainties, and they are more susceptible to natural catastrophes (Meffe and Carroll 1994). The extent to which Alaska steelhead stocks interact as metapopulations (that is, a population composed of interacting subpopulations in a landscape of suitable and unsuitable habitat patches) both within and among watersheds, is unknown. Application of the concept to steelhead might, however, reveal insights into their demography, stock delineation, and probability of survival (see Rieman and McIntyre 1993).

Rieman and McIntyre (1993) evaluated the relative influence of population size, reproductive rate, exchange of individuals among metapopulations, and correlation of environmental factors among metapopulations to determine the probability of survival for bull trout (*Salvelinus confluentus*) in several areas of the Northwestern United States. A similar analysis may be possible with existing data for steelhead escapement indices in southeast Alaska. Estimates of straying (exchange) among stocks would assist such an analysis. A low incidence of straying (<3 percent) was observed in a wild steelhead stock in California (Shapovalov and Taft 1954), and the same may be the case for Alaska stocks.

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[16] Personal communication. 1995. D. Jones, Alaska Department of Fish and Game, Sport Fish Division, P.O. Box 240020, Douglas, AK 99824.

[17] Personal communication. 1995. S. Elliott, Alaska Department of Fish and Game, Sport Fish Division, P.O. Box 240020, Douglas, AK 99824.

The review of existing data considering the extensive range and large number of watersheds that support steelhead reveals the paucity of data needed to assess the current status and risks to individual stocks in southeast Alaska. Although the stocks included in this review show a wide range of life-history strategies, data to determine genetic differences or the effects of environmental factors on stock characteristics are absent. Systematic studies of the life-history patterns and habitat requirements of juvenile steelhead in fresh water are lacking throughout southeast Alaska. Existing data do show that steelhead are an increasingly valuable resource to the sport fishery and are susceptible to habitat degradation and overexploitation.

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We reviewed existing data to determine the range and distribution of steelhead (*Oncorhynchus mykiss*) in southeast Alaska, summarized biological characteristics, and determined population status of steelhead stocks. Unique or sensitive stocks that may require consideration in planning land management activities are identified within the data reviewed. The objectives were to measure age structure, sex ratio, incidence and frequency of repeat spawning, and body length. Assessment of escapement trends, run timing, and stock status is hindered by lack of adequate data both in number of stocks with sufficient data and the number of years of data available. Although stocks with sufficient data are not at risk, small run sizes that are typical of most steelhead stocks may be more susceptible to poor land management practices and overharvest than larger stocks.

Keywords: Steelhead, stock assessment, Alaska, management, biological review.

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